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ABSTRACT

This paper describes the developmental approach to moral education guided by the view that the student is an active constructor of knowledge who progresses through a succession of increasing psychologically and philosophically robust stages of moral reasoning. The developmental approach to moral education attempts to avoid the arbitrary norms of society and naturalistic fallacy by coordinating philosophical principles of human actions and values with the facts of natural stage growth. Teaching strategies used when discussing moral, ethical, and science-technology-society (STS) issues need to be consistent with the moral growth stages of their students so that meaningful learning will occur. The strategies for using moral dilemmas and STS vignettes and an illustrative sample moral dilemma are included. A table illustrating Kohlberg's Moral Stages of Reasoning is attached. (KR)

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VALUES, MORALITY AND STS ISSUES: A DEVELOPMENTAL PERSPECTIVE

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VALUES, MORALITY AND STS ISSUES: A DEVELOPMENMTAL PERSPECTIVE

Crises and Change

Eminent national science organizations are finally acknowledging what science teachers have know for a long time; that today's curricula are "overstuffed and undernourished" (AAAS, 1989, p.14). The American Association for the Advancement of Science initiated Project 2061, a task force designed to put forth a national goal of scientific literacy for all Americans to move us into the next millennium. While the idea of promoting scientific literacy is not new, the public recognition that needless redundancy in many school curricula preempts the teaching of other areas of greater societal and technological importance to contributing to a national goal is a rather novel position statement.

Criticisms of crisis proportions have been leveled at much of our science textbooks, curricula and teaching practices both from within the science education community and the public sector. It has even been claimed that traditional approaches have actually impeded growth toward scientific literacy by emphasizing memorization of isolated bits of information rather than fostering critical thought and the free exchange of different ideas. The bridge to the future for American Science Education will only by crossed if educational reform becomes a comprehensive endeavor. For this change to occur, AAAS (1989, p.5) advises that we must

be willing to:

-reduce the sheer amount of material covered;

-weaken or eliminate rigid subject matter boundaries;

-pay more attention to the connections among science, mathematics and technology;

-present the scientific endeavor as a social enterprise that strongly influences--and is influenced by--human thought and action;

-foster scientific ways of thinking.

Bandwagon Jumping and Quick Fixes

Many conscientious teachers recognize these goals, and over the years numerous STS programs and modules have been developed in an effort to address them. It is very tempting to purchase and to use these intact units in our classes and to feel that we have done our part to remedy the problems. Welcome on another bandwagon!

The problem with many "prepackaged" programs is that when the novelty wears off, we are still confronted with the job of getting students into the habit of individually and collectively thinking and reasoning critically for themselves. This is precisely the reason many STS programs fall short of their mark. Even when we present a highly structured but nevertheless well thought out program we often only succeed in making a quick fix. The problem of getting students to deal with issues in a manner that will foster the development of individual reasoning skills and autonomous

reflective thought still remains (Zeidler,1987).

Perhaps more important, as science teachers move to incorporate more societal and technological issues and discuss their "value implications" , they are prone to unwittingly convey the idea to their students that any value a given society derives for itself is appropriate for that society, and hence that any of the values students select for themselves from their own culture are fundamentally equivalent. The problem inherent to such a relativistic approach is that it is either arbitrary at best, or indoctrinative at worst. This approach reflects an error in thinking referred to in the literature as the "psychologist's fallacy" or the "naturalistic fallacy" and arises when we try to form ethical imperatives (what ought to be) from factual observations of human and social nature (what is currently the case). Thus, we may observe that a society does X, or people tend to act in a certain way, and fail to ask ourselves, "But is this desirable?" Failure to ask this question slides over the distinction between "what is" and "what ought to be" (Kohlberg,1971).

We must be very careful, then, of "quick fix" approaches and programs. As science teachers facing a new generation of goals and concerns we need to become better informed as to how we can effectively present value-laden social and technological issues. Ideas presented to students must be sufficiently flexible that they can be adapted to most science content areas to meet the needs of both teachers and

students of conventional introductory science courses. But the teacher must use sound judgment and creativity in incorporating these ideas so it may be aligned with their subject matter. The reminder of this article is devoted to providing an introductory framework and "starter set" of teaching strategies to help our goals in a developmentally productive manner.

A Developmental Approach

In contrast to doctrinaire approaches which define morality in terms of fixed rules and virtues taught by inculcation and reinforcement, and in contrast to values clarification approaches that view values a completely relative, neither correct nor incorrect, the developmental approach to moral education is guided by the view that the child is an active constructor of knowledge who progresses through a succession of increasing increasing psychologically and philosophically robust stages of moral reasoning. Hence, the developmental approach to moral education attempts to avoid the arbitrary norms of society and the naturalistic fallacy by coordinating philosophical principles of human actions and values with the facts of natural stage growth.

Arguably the most comprehensive theory of moral development to date that has contributed to useful classroom strategies is the work of Lawrence Kohlberg. Kohlberg (1972; 1978) has expanded the cognitive-developmental work of Piaget to build a stage theory of how children develop the capacity

for moral reasoning. It is pedagogically important for science teachers to have an appreciation of the characteristics of these stages of moral reasoning to ensure that their teaching strategies (when discussing moral, ethical and STS issues) are consistent with the moral growth stages of their students, just as knowledge of cognitive development permits us to organize and present our science lessons in such a way as to facilitate the intellectual growth of our students. Therefore, a brief discussion of Kohlberg's moral development stage theory is warranted.

Kohlberg's Moral Stage Theory

Unlike other psychology theories of moral growth which are dependent up[on content or situational and cultural specific experiences, Kohlberg (1973) has advanced the assertion of universal moral stages of development by observing that the logic behind peoples' reasoning about moral problems appears to follow predictable patterns of developmental growth. Therefore, the study of moral reasoning is based on the examination of specific features of thought processes (i.e. structures) throughout different stages of development, and reflects the individual's interpretation of rules and principles in conflict situations. these stages progress in a sequential, invariant and hierarchical fashion. Kohlberg advances the claim that each stage is more philosophically adequate than the previous level. That is, each higher stage is more preferable

according to certain philosophical criteria; higher stages of moral reasoning better fulfill the criteria of impersonality, ideality, universalizability, and preemptiveness. Hence, there is an isomorphism or parallelism between the developing moral structures of the child's psychological stages and the formal philosophical justification of advanced moral premises. It is this psychological and philosophical consistency that serves as a developmental framework for the teaching of moral and ethical issues in the classroom.

The table of moral stages of reasoning (Table 1) outlines these stages of development. As can be seen there, the earliest, or preconventional stages are dominated by egocentric and egoistic reasoning. The child's focus is purely on advancing one's own needs by directly self-serving actions. In the subsequent, conventional, stages (preadolescence-adolescence), a child's moral reasoning begins to shift toward others who are immediately important to his or her person (family, friends, teachers, etc.) and attempts to fulfill normative expectations based on stereotypical images of proper conduct to gain their approval. The latter part of the conventional level is marked by orientations to fulfill fixed social duties, rules and maintaining social order. Finally, the postconventional level of moral reasoning (adolescence-adulthood) is characterized by a change in reasoning that encompasses a contractual, legalistic view of due process, a utilitarian concern for social justice, and a respect for universal

ethical principles.

It is important to note that Kohlberg's model is in alignment with the formal criteria of cognitive developmental theory (increasingly complex differentiation and integration of stages). Moral development, then, occurs along a parallel path in juxtaposition but distinct from cognitive development. Research has revealed that cognitive development is a necessary but not sufficient condition for moral growth (Zeidler,1985). For example, formal operations in the cognitive domain are needed by a child in order to function at the stage of postconventional moral reasoning, but the ability to do so does not ensure that postconventional logic will take root. Research also reveals that individuals tend to prefer the highest stages of reasoning available to them (although they are not likely to utilize those stages in most situations) and are inclined to align their reasoning with those individuals who are slightly more developmentally advanced (Zeidler & Schafer,1984). This implies that the science teacher's role is to ensure the conditions conducive to moral growth are available to their students.

The following section addresses how these ideas may be incorporated into the science classroom through the use of carefully selected science-technology-society issues.

Strategies for Using Moral Dilemmas and STS Vignettes

Currently, there exists a multitude of source materials

and infusion units available in the current literature and the educational market place which provide teachers with the options of selecting topics as brief issues for casual reflection ("food for thought") or as a means for promoting deeper investigation and analysis into compelling ethical STS issues. The latter will require a certain amount of forethought and planning, but the creative teacher will find that most STS type vignettes can be extended and adapted into their repertoire of classroom strategies which will promote the integration of content and societal issues, and contribute to the moral growth of their students. One example of this approach will soon follow. There are, however, some important considerations to be aware of in the process of creating moral dilemmas and conducting classroom discussions.

Effective dilemmas have plausible but competing claims with no clear social norms governing its' resolution and a basis of content and context relevant to some realm of the students; lives. The classroom climate must also be constructed so as to stimulate the moral growth of the student. This is, in part, achieved be providing the following elements of experience: role-taking opportunities, intellectual stimulation, responsibility, cognitive-moral conflict, peer interaction and a democratic communicative environment (Zeidler,1984).

Typically, teachers who successfully develop their own "tailor made" dilemmas recognize the importance of including

five main elements: (1) The dilemma should have a major **focus** which is related directly (or at least indirectly) to the course content, life experiences (present or future) of the student or some realm of social significance. Of course, the most creative dilemmas incorporate all of these features. (2) The dilemmas should clearly delineate a **central character(s)** or a primary group(s) of people who are confronted with two or more competing claims or conflicts. (3) The main characters have been placed in a situation that necessitates a **choice**. These characters are confronted with the problem of having to choose among competing claims, mutually exclusive decisions and conflicts of interest that have no clearly discernible socially acceptable answer. (4) Effective dilemmas usually center on one or more **moral issue** or common moral values that are of importance to persons resolving the problem. Moral issues commonly confronted include punishment, property, roles and concerns of affection, roles and concerns of authority, law, life, liberty, distributive justice, truth and sex. (5) Finally, effective dilemmas should include **probes** which the teacher, as a facilitator, should be prepared to implement at various times. Some of these probes are: (1) clarifying probes - to make sure what kind of reasoning is being conveyed; (2) general probes - used to elicit responses about the dilemma; (3) issue-specific probes - used to focus students' attention on a specific issue; (4) stage-higher probe - used to confront a student with a problem that cannot be adequately

resolved at his or her predominant stage of moral reasoning; (5) role-taking probe - used to encourage students to make claims about a moral dilemma based upon different perspectives of individuals or events involved in that particular dilemma. It is important that many of the probes be aimed at eliciting prescriptive judgements form the students ("What should X do...?", rather than "What would X do...?" and require that students justify their responses so as to reveal the logic behind their reasoning (Galbraith & Jones,1976; Scharf,1978; Zeidler,1984).

When selecting vignettes to foster the types of critical analysis, personal reflection and moral growth discussed previously, it is useful to think how two or more issues may be incorporated into a common theme relevant to the course content. One particular useful collection of STS infusion units may be found in Brinckerhoff (1990), who categorizes the units into various content areas. As an illustrative example, elements of the vignettes entitled "Destruction of Species" (p.44), "Worthless Species" (p.50), "Underground Toxic Wastes" (p.88), and "Hazardous Chemicals, Dioxin, and Molecular Formulas" (p.80) may be combined and incorporated into material appropriate for biology, chemistry or earth science classes (grades 10-12 for this example).

An Illustrative Sample Moral Dilemma

Focus: To analyze an example of the impact of chemical pollution and to identify our obligations to society and to

other forms of life.

Central Character: Norm

Choice: Whether to report hazardous industrial waste to the public and to the proper authorities (in order to protect the health of fellow workers or to save an endangered species), or whether to work under the guidelines of his contract, ensure fellow workers and himself of his livelihood, and protect national security interests.

Moral Dilemma: USA Technologies, Inc.

Norm, a bright young college graduate who majored in chemical engineering, has been hired by a local scientific research company named USA Technologies, Inc., or USA Tech as it is known in the local community. USA Tech is one of the major sources of employment for Petersburg, a pleasant community that has suffered great financial hardships because of the closing of several mills over the past fifteen years. Before USA Tech located in Petersburg the town had not been growing, and many people have had to give up their homes and move away to search for employment or drive two or three hours a day to find work in other areas. USA Tech has given "new life" and hopes to Petersburg.

USA Tech holds several large U.S. government defense contracts. Norm was interviewed the beginning of his senior year in college and offered a position with USA Tech that would offset all of his college bills and start him at a high salary. Norm knew he would be required to sign a

contract that swore him to secrecy because of the sensitive nature of USA Tech's research for the U.S. Department of Defense.

Norm, brimming with excitement over his new job, felt a sense of pride because he was putting his knowledge to practical use, advancing scientific knowledge, and aiding his country. He had been hoping to develop a new fuel which was much more efficient than regular fuels and less expensive to manufacture. Norm realized that the development of this new fuel could save the country billions of dollars a year.

Norm's excitement was soon shattered when he found out that in the process of making the secret fuel there had been carcinogenic (cancer-causing) by-products released into the environment. He also discovered that the health of people who worded in the department that produced this fuel showed more illnesses than any other department of the company. Norm immediately reported this to his supervisors who thanked him for pointing this out and promised to correct the apparent exposure problem.

In the meantime a group of environmentalists known as Ecology Watch had discovered that a rare species of animal only found in that region of the country was producing deformed offspring because of some carcinogenic contamination in their food chain. Ecology Watch reported that they did not know the source of the contamination but the threatened animal is clearly in danger of extinction.

Norm immediately realizes that USA Tech is likely

responsible for this problem too. Again he tells his supervisors, but he is surprised by their reactions. They remind him that he should be thankful to work for the company and to have had them pay for all of his college expenses. They also point out that the government may be able to save its taxpayers billions of dollars a year with the development of the new fuel which is very much needed for other important projects such as health programs for the poor and for the homeless. They tell him that "going public" with this information could also force the closing of the company, causing many families to be out of work, and they remind him that his contract binds him to secrecy.

Should Norm go public with this information? Why?

YES CAN'T DECIDE NO

Probe Questions:

1) Should Norm tell only the workers in his department of the potential risks although one of them may to to the press with this news? Why/Why not?

2) From the point of view of the supervisors in the company, should Norm ever be trusted again if he decides to go public with the information? Why?/Why not?

3) Should Norm feel responsible for the loss of jobs if the plant is forced to closed because he has made the news public?

4) Suppose some of the other workers in Norm;s department

were very close friends. How should this affect his decision? Explain.

5) Suppose Norm does decide that the economic benefits outweigh the danger to the people in his department. Should he still report his information concerning the possible contamination found in the environment to the Ecology Watch group? Why?/Why not?

6) Suppose the animal species in question is considered a "pest" or a "nuisance" such as a poisonous snake or a scorpion. Should this affect his decision? Explain.

7) Should the animal be saved in light of the economic hardships facing the people in Petersburg? Why?/Why not?

8) From the point of view of the workers in Norm's department, is it more important for him to keep his oath and contract or risk their livelihood and health? Why/Why not?

9) Do we have the right, because we have the power, to decide the fate of another creature? Explain.

10) If Norm feels that the extra money that can be saved by producing this special fuel is not important, should that affect his decision? Why?/Why not?

A Final Note to Science Teachers

As can be understood by the illustrative example, many STS type vignettes can be combined in interesting ways and provide a powerful means by which teachers may incorporate ethical issues with science content appropriate for their respective disciplines and foster the moral growth of

students. This is by no means an easy task. Teachers who understand the pedagogical rationale for dealing with ethical, moral and STS issues in a manner consistent with the psychological growth of the child will find that the time invested in developing their own dilemmas based on existing resources, is returned in the form of enhanced student reasoning, interest and relevant subject matter.

The strategies presented here serve as a basis for teachers to begin tailoring vignettes into replete moral dilemmas for investigation. Teachers will no doubt find that they become constantly challenged to understand the developmental processes guiding their students' reasoning. But such challenges also offer the opportunity to be imaginative and creative with developing strategies to enhance students' learning of interrelated STS concepts and facilitate their intellectual talents. Teachers who make this commitment will help to effect change amid crises in science education.

Table 1: MORAL STAGES OF REASONING

I. Preconventional level

At this level, the child is responsive to cultural rules and labels of good and bad, right or wrong, but interprets these labels either in terms of the physical or the hedonistic consequences of action (punishment, reward, exchange of favors) or in terms of the physical power of those who enunciate the rules and labels. The level is divided into the following two stages:

Stage 1: *The punishment-and-obedience orientation.* The physical consequences of action determine its goodness or badness, regardless of the human meaning or value or these consequences. Avoidance of punishment and unquestioning deference to power are valued in their own right, not in terms of respect for and underlying moral order supported by punishment and authority (the latter being Stage 4).

Stage 2: *The instrumental-relativist orientation.* Right action consists of that which instrumentally satisfied one's own needs and occasionally the needs of others. Human relations are viewed in terms like those of the marketplace. Elements of fairness, of reciprocity, and of equal sharing are present, but they are always interpreted in a physical, pragmatic way. Reciprocity is a matter of "you scratch my back and I'll scratch yours," not of loyalty, gratitude, or justice.

II. Conventional level

At this level, maintaining the expectations of the individual's family, group, or nation is perceived as valuable in its own right, regardless of immediate and obvious consequences. The attitude is not only one of *conformity* to personal expectations and social order, but of loyalty to it, of actively *maintaining*, supporting, and justifying an order, and of identifying with the persons or group involved in it. At this level there are the following two stages:

Stage 3: *The interpersonal concordance or "good boy-nice girl" orientation.* Good behavior is that which pleases or helps others and is approved by them. There is much conformity to stereotypical images of what is majority or"natural" behavior. Behavior is frequently judged by intention--"he means well" becomes important for the first time. One earns approval by being "nice."

Stage 4: *The law and order orientation.*. There is orientation toward authority, fixed rules and the maintenance of the social order. Right behavior consists of doing one's own duty, showing respect for authority, and maintaining the given social order for its own sake.

III. Postconventional, autonomous, or principled level.

At this level, there is a clear effort to define moral values and principles that have validity and application apart from the authority of the groups or persons holding these principles and apart from the individual's own identification with these groups. This level also has two stages:

Stage 5: *The social-contract, legalistic orientation*, generally with utilitarian overtones. Right action tends to be defined in terms of general individual rights and standards which have been critically examined and agreed upon by the whole society. There is a clear awareness of the relativism of personal values and opinions and a corresponding emphasis upon procedural rules for reaching consensus. Aside from what is constitutionally and demographically agreed upon, the right is a matter of personal "values" and "opinion." The result is an emphasis upon the "legal point of view," but with an emphasis upon the possibility of changing law in terms of rational considerations of social utility (rather than freezing it in terms of Stage 4 "law and order"). Outside the legal realm, free agreement and contract is the binding element of obligation. This is the "official" morality of the American government and Constitution.

Stage 6: *The universal ethical-principal orientation.* Right is defined by the decision of conscience in accord with self-chosen *ethical principals* appealing to logical comprehensiveness, universality, and consistency. These principals are abstract and ethical (the Golden Rule, the categorical imperative); they are not concrete moral rules like the Ten Commandments. At heart, these are universal principals of *justice*, of *reciprocity* and *equality* of human *rights*, and of respect for the dignity of human beings as *individual persons*.

(Kohlberg, 1971, pp 164-165)

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